Remarks

Claims 7, 13, 14, 26, 29, 30, 37, 43, 44, and 56 have been cancelled. Claims 8, 32, 38, 47, 48, 51-52 have been amended. Claims 1-6, 8-12, 15-25, 27-28, 31-36, 38-42, 45-55 remain in this application.

Claim Objections

Examiner objected to claims 8, 38 and 51 for lacking proper antecedent basis, and requested appropriate correction. Claims 8, 38 and 51 have been amended and a request for allowance is hereby made.

Examiner objected to claims 47, 48 and 52 for lacking proper antecedent basis, and requested appropriate correction. Claims 47, 48 and 52 have been amended and a request for allowance is hereby made.

Examiner objected to the usage of the word "it" in claim 32 and requested appropriate correction. Claim 32 has been amended and a request for allowance is hereby made.

Claim Rejections – 35 USC § 103

Examiner rejected claims 1-13, 15-29, 31, 33-43 under 35 USC 103(a) as being unpatentable over Deliwala (US Patent Application Publication 2003/0039430) in view of Nozaki (JP 01-107213 A).

Claims 1, 19 and 31

Claims 1, 19 and 31 have been rejected as being unpatentable over Deliwala in view of Nozaki. Examiner asserts that Deliwala teaches a waveguide grating coupler for

coupling light between a waveguide and an optical element having a substantially Gaussian mode profile, said waveguide grating coupler comprising:

a planar guiding portion optically connected to said waveguide, said planar guiding portion having first and second ends and an optical power distribution therein that decreases between said first and second ends; and

a plurality of elongate scattering elements.

Deliwala only teaches that "Light is injected into the waveguide 106 via the input light coupler 112 and light exits from the waveguide 106 via the output light coupler 114" and suggests that an alternative coupling means like "gratings" may be used. Further, Examiner wrongly points out Deliwala as teaching a plurality of elongate scattering elements 112. The said element 112 (Deliwala, Fig. 1) is only an input light coupler, not a scattering element.

Examiner acknowledges that Deliwala does not disclose the "scattering elements having respective scatter cross-sections arranged along at least a portion of said planar guiding portion to couple light having a substantially Gaussian intensity distribution between said planar guiding portion and said optical element, said elongate scattering elements having at least one characteristic which varies in magnitude among at least a group of said elongate scattering elements, said magnitude of said characteristic controlling at least in part said scatter cross-sections of said elongate scattering elements,

wherein said magnitude of said characteristic of said group of elongate scattering elements varies irregularly, said magnitude for said group of elongate scattering elements changing with position along said planar guiding portion at a rate that is discontinuous." However, examiner asserts that the aforequoted is taught by Nozaki,

further citing the grating coupler 21 of figure 3 in Nozaki, and the Abstract of Nozaki. Examiner has erred in her contention, as the cited reference explicitly teaches use of Gaussian intensity distribution in the travelling direction of light which light beam is converged "into the small beam spot Q through a scanning lens 26 to scan (main scan) on a photosensitive body 23" clearly indicating that Nozaki's teaching is directed to a scanning or photocopying device as it were. Further, the gratings described in Nozaki have a grating profile in which the grating strength increases and then decreases. This grating will not produce a Gaussian mode distribution. It can be shown mathematically that in their embodiments of a grating, to achieve a substantially Gaussian mode, the grating strength will have to increase monotonically.

In re Deminski, 796 F.2d 436, 230 USPQ 313 (Fed. Cir. 1986) states that "Under the two-step test for determining whether a prior art reference is nonanalogous and thus not relevant to determining obviousness, it must be determined (1) whether the reference is "within the field of the inventor's endeavor," and (2) if not, whether the reference is "reasonably pertinent to the particular problem with which the inventor was involved." The claimed invention and reference patents are within the same field of endeavor if they have essentially the same function and structure..." Nozaki teaches a variation in the grating height in the diffraction grating which variation is used in image capture when reflected light from the image in question is converted into a small beam spot Q through a scanning lens 26. In contrast, Applicant's claims teach "elongate scattering elements having at least one characteristic which varies in magnitude" which variation is used to define and transport data/information along distances. Clearly, Nozaki's teaching is substantially dissimilar from Applicant's claims in both function and structure. Also,

Nozaki and Deliwala are non-analogous vis-à-vis each other, and thus vis-à-vis Applicant's claims. Deliwala does not teach a Gaussian profile for optimal coupling characteristics and Nozaki's teaching incorporating scanning lens cannot possibly be implemented internally on Deliwala's invention.

Consequently, and in light of the above, Applicant's claims 1, 19 and 31 are not anticipated by the cited references of Deliwala in view of Nozaki. Applicant thus respectfully requests that 103(a) rejections to claims 1, 19 and 31 be withdrawn and a notice of allowance be made.

Claims 2, 20 and 34

Regarding claims 2, 20 and 34, while optical fibers coupled to waveguide grating couplers may very well be well known in the art, Applicant is claiming an optical element that happens to comprise an optical fiber. It is the optical element that is coupled to the waveguide grating coupler. Applicant maintains that such an arrangement is not obvious in light of the cited teachings. Consequently, in light of the above, Applicant respectfully requests that 103(a) rejections to claims 2, 20 and 34 be withdrawn and a notice of allowance be made.

Claims 3 and 21

Regarding claims 3 and 21, claims 3 and 21 teach of varying characteristics of elongate scattering elements, which characteristics vary in height, width, and position on a planar surface. Further, these characteristics vary irregularly. In contrast only Nozaki teaches of a diffraction grating wherein the height of the grating varies to a mountain

shape. This grating will not produce a Gaussian mode distribution, which distribution can only be achieved if the grating strength varies monotonically. In other words, Nozaki's structure is very different from that taught in Applicant's claims 3 and 21. For the teaching of Nozaki indicates that the variation in height is the only variation and is regular, unlike Applicant's claims wherein magnitude of characteristics varies irregularly, which variation is dependent upon specific positions of elongate scattering elements on a planar surface. Additionally, Deliwala does not teach of any such varying characteristics. Applicant respectfully disagrees with Examiner, and maintains that the cited references do not render Applicant's claims obvious. Consequently, Applicant respectfully requests that a 103(a) rejection to claims 3 and 21 be withdrawn and a notice of allowance be made.

Claims 4, 5, 23, 33 and 35

Regarding claims 4, 5, 23, 33 and 35, Applicant respectfully disagrees with Examiner. It would be presumptuous to infer that the teaching of Nozaki which states that "the grating height of the diffraction grating 21 is varies in the mountain shape" would render obvious that one of several characteristics varies (as disclosed by Applicant) or that a rate of change of magnitude of characteristics could be devised by referring to Deliwala and Nozaki. While Nozaki's teaching is non-analogous art (and, incidentally, would not produce a Gaussian mode distribution), Deliwala does not even teach of a Gaussian mode profile. Consequently, in light of the above, Applicant respectfully requests that a 103(a) rejection to claims 4, 5, 23, 33 and 35 be withdrawn and a notice of allowance be made.

Claims 6, 25 and 36

Regarding claims 6, 25, and 36, Examiner has cited "interface 7206 and 7208." As per the teaching of Deliwala, 7208 is positioned adjacent to 7206 resulting in total internal reflection of light, which total internal reflection aides in propagating light in a forward direction. It cannot be inferred from the cited reference, that 7208 is constructed for the purpose of confining light in a transverse direction. Further, figure 3 of Nozaki does not expressly or implicitly indicate a planar guiding portion having sidewalls to confine light in a transverse direction. Applicant disagrees with Examiner, and in light of the above respectfully requests that a 103(a) rejection to claims 6, 25 and 36 be withdrawn and a notice of allowance be made.

Claims 7, 26 and 37

Claims 7, 26 and 37 have been cancelled.

Claims 8 and 38

Regarding claims 8 and 38, neither Nozaki nor Deliwala teach of the relationship by which optical power distribution decreases between first and second ends of planar guiding portion in accordance with a relationship defined by the complimentary error function. Although a natural decrease in optical power distribution is mentioned, nowhere is it cited that the complementary error function is taken advantage of in the working of the invention. Thus, Applicant respectfully requests that 103(a) rejections to claims 8 and 38 be withdrawn and a notice of allowance be made.

Claims 9, 27 and 39

Regarding claims 9, 27 and 39, while the variation in grating height of the diffraction grating is taught in Nozaki, which incidentally is non-analogous art, nowhere is it expressly or implicitly taught, either by Nozaki or Deliwala, that at least one characteristic is selected from the group consisting of grating width, height, spacing, depth, or/and index of refraction of said "elongate scattering elements." Consequently, in light of the above, Applicant's claims 9, 27 and 39 are not obvious in light of the cited references. Therefore, Applicant respectfully requests that 103(a) rejections to claims 9, 27 and 39 be withdrawn and a notice of allowance be made.

Claims 10, 22 and 40

Regarding claims 10, 22 and 40, figure 3 of Nozaki shows a diffraction grating of consistent width and spacing, with a varied height in accordance with a Gaussian profile. This reference is substantially different from the teachings of Applicant's claims 10, 22 and 40, where it is expressly stated that the plot of magnitudes of characteristics associated with elongate scattering elements (height, width, spacing, depth, etc.) versus position along guiding portion where the elongate scattering elements are substantially offset from a single exponential or Gaussian function that is fit to said plot. Additionally, the gratings described in Nozaki will not produce a Gaussian mode distribution, which Gaussian mode can only be achieved if/when the grating strength increases monotonically. Consequently, in light of the above, Applicant's claims 10, 22 and 40 are not obvious in light of the cited references. Thus, Applicant respectfully requests that 103(a) rejections to claims 10, 22 and 40 be withdrawn and a notice of allowance be made.

Claims 11, 24 and 41

Regarding claims 11, 24 and 41, it is specifically mentioned that the plurality of elongate scattering elements comprises at least 20 elongate scattering elements. Applicant contends that in context of Applicant's invention, a person skilled in the art cannot arrive at the figure of 20 elongate scattering elements without a substantial degree of experimentation. Neither Nozaki nor Deliwala teaches of 20 elongate scattering elements. Thus Applicant's claims 11, 24 and 41 are not obvious in view of Deliwala over Nozaki. Consequently, in light of the above, Applicant respectfully requests that 103(a) rejections to claims 11, 24 and 41 be withdrawn and a notice of allowance be made.

Claims 12, 28 and 42

Regarding claims 12, 28 and 42, the cited references, individually or combined, do not at any point teach of the relationship wherein the magnitude of the characteristic at different positions along the planar grating is selected such that the variation in scatter cross-sections of the group of elongate scattering elements as a function of longitudinal distance across the group of elongate scattering elements satisfies the relationship $G(z) = F(z)E(z)$ where G(z) corresponds to said substantially Gaussian mode profile of said optical element, and E(z) corresponds to optical power distribution that decreases between said first and second ends. To put Nozaki in perspective, if F(z) has a mountain shape or in general, is smoothly increasing and then decreasing, then F(z) is substantially Gaussian. Now if G(z) is Gaussian as well, we obtain a constant E(z) (approximately.) However, since light is scattered out of the waveguide, E(z) would have to be decreasing

monotonically with z to obtain a substantially Gaussian mode distribution. Thus the gratings described by Nozaki cannot possibly produce a Gaussian mode profile. Deliwala, on the other hand, does not at any instance teach of a Gaussian mode profile. In light of the above, Applicant respectfully requests that a 103(a) rejection to claims 12, 28 and 42 be withdrawn and a notice of allowance be made.

Claims 13, 29 and 43

Claims 13, 29 and 43 have been cancelled

Claims 15-18

Regarding claims 15-18, the cited reference only teaches a waveguide that includes a substrate and that is sandwiched between a first and second insulator layer, not that the waveguide "grating" coupler itself comprises a substrate wherein the planar guiding portion of the waveguide grating coupler is disposed over the substrate. Applicant's claims are very specific and when Figures 1-5 of Applicant's invention are compared with the figures related to the cited references, the differences become apparent. Further, both the cited reference and Applicant's claims perform similar (but not same) functions; there is nothing that makes Applicant's method obvious in light of the teaching of Deliwala especially in view of the narrowness of Applicant's claims 15-18. Applicant disagrees with Examiner; there are several methods by which an objective can be accomplished. It would be presumptuous to conclude that all methods that accomplish similar objectives are obvious in light of a single disclosed method. Consequently, in light of the above, Applicant respectfully requests that 103(a) rejections to claims 15-18 be withdrawn and a notice of allowance be made.

Examiner rejected claims 1, 14, 19, 30, 31 and 44-56 as being unpatentable under 35 USC 103(a) over Deliwala in view of Li et al. (US Patent 5,657,407).

Claims 1, 19, 31 and 45

Examiner has acknowledged that Deliwala does not disclose scattering elements having respective scatter cross-sections arranged along at least a portion of said planar guiding portion to couple light having a substantially Gaussian intensity distribution between said planar guiding portion and said optical element, said elongate scattering elements having at least one characteristic which varies in magnitude among at least a group of said elongate scattering elements, said magnitude of said characteristic controlling at least in part said scatter cross-sections of said elongate scattering elements, wherein said magnitude of said characteristic of said group of elongate scattering elements varies irregularly, said magnitude for said group of elongate scattering elements changing with position along said planar guiding portion at a rate that is discontinuous, wherein said magnitude of said characteristic for said plurality of elongate scattering elements versus position along said guiding portion includes at least one elongate scattering element substantially offset from a single exponential or Gaussian that is fit to said plot, wherein said elongate scattering elements are relatively positioned to provide said substantially Gaussian intensity distribution of said coupled light and said decay of said optical power distribution in said coupler, or wherein said elongate scattering elements having widths which vary in magnitude among at least some of said elongate

scattering elements, said widths controlling at least in part said scatter cross-sections of said elongate scattering elements as defined by a relationship between widths and scatter cross-sections, said relationship including at least two widths that provide substantially similar scatter cross-sections, wherein said elongate scattering elements are relatively positioned to provide said substantially Gaussian intensity distribution of said coupled light and said decrease of said optical power distribution in said coupler.

The cited reference of Li et al (Figure 2) only teaches a preference for a Gaussian profile for an output beam. The cited reference does not at any point explicitly teach of how to design the grating in a way to achieve a Gaussian mode profile. Further, the specification does not at any point teach of "scatter cross-sections arranged along at least a portion of planar guiding portion to couple light having a substantially Gaussian intensity distribution between said planar guiding portion and said optical element..." The cited reference does not at any point imply that "said elongate scattering elements having at least one characteristic which varies in magnitude among at least a group of said elongate scattering elements, said magnitude of said characteristic controlling at least in part said scatter cross-sections of said elongate scattering elements..." Li et al only teaches of the advantages of a parallelogramic grating coupler in enhancing coupling efficiency with a preference for a Gaussian profile for an output beam. Li et al also discloses a variable width to pitch ratio, but not that "said elongate scattering elements...varies in magnitude...said magnitude of said characteristic controlling at least in part said scatter cross-sections of said elongate scattering elements..."

It would be presumptuous to conclude that from the cited references of Deliwala and Li, neither of which incidentally teaches scattering elements as taught in Applicant's

claims, that Applicant's invention would be obvious in light of the cited references. Further, a combination of Deliwala and Li et al's teachings would only lead to enhanced coupling efficiency, not to a waveguide grating coupler wherein the magnitude of the characteristics of "elongate scattering elements varies irregularly, said magnitude for said group of elongate scattering elements changing with position along said planar guiding portion at a rate that is discontinuous." Applicant asserts that the cited references do not anticipate Applicant's claims, and that Applicant's claims are substantial improvements in the art. Further, it would be impossible for a person skilled in the art to design a grating that achieves a Gaussian mode profile from the information presented by Li. Consequently, and in light of the above, Applicant respectfully requests that 103(a) rejections to claims 1, 19, 31 and 45 be withdrawn and a notice of allowance be made.

Claims 14, 30, 44 and 56

Claims 14, 30, 44 and 56 have been cancelled.

Claim 46

Regarding claim 46, Examiner contends that optical fibers coupled to waveguide grating couplers are well known in the art. However, Applicant's claim is for an optical element, which optical element happens to comprise an optical fiber wherein a waveguide grating coupler couples light between a waveguide and said optical element. Consequently, in light of the above, Applicant maintains that claim 46 is not obvious in light of existing prior art. Thus, Applicant respectfully requests that 103(a) rejection to claim 46 be withdrawn and a notice of allowance be made.

Claim 47

Regarding claim 47, the magnitude of width changes with position along planar grating portion, and is not, as in the cited reference, dependent upon the ratio of the width of the grate to the distance from an adjacent grate. Therefore, and in light of the above, Applicant disagrees with Examiner's perception that claim 47 is obvious in view of the cited references of Deliwala and Li et al. Thus, Applicant respectfully requests that 103(a) rejection to claim 47 be withdrawn and a notice of allowance be made.

Claim 48

Regarding claim 48, the cited reference of Li only teaches of a variable "width to pitch ratio" and not the limitation that the magnitude of said widths both increase and decrease between said first and second ends. Applicant disagrees with Examiner, and maintains that the objective through claim 48, even in light of the cited prior art, cannot be achieved without substantial experimentation. Consequently, and in light of the above, Applicant respectfully requests that 103(a) rejection to claim 48 be withdrawn and a notice of allowance be made.

Claim 49

Regarding claim 49, Examiner has cited "interface 7206 and 7208." The cited reference does not at any point teach of a guiding portion having sidewalls specifically "to confine light in a transverse direction." The cited interface, 7208, is an insulation to aid in Total

Internal Reflection only. Obviousness is emphatically precluded specifically in light of the cited references, especially that of Li et al. where it is expressly taught that the guiding portions on the planar surface are substantially parallelogramic in nature, and which guiding portions have sidewalls "having a substantially parallel relation to one another and being positioned with angles of less than 90.degree. relative to said optical axis" (Claim 2). This parallelogramic structure forms the crux of Li's teaching. Therefore, in light of the above, Applicant respectfully requests that a 103(a) rejection to claim 49 be withdrawn and a notice of allowance be made.

Claim 50

Examiner has rejected claim 50 as being obvious over Deliwala in view of Li et al. Examiner indicates that the references teach of a planar guiding portion selected from the group consisting of a channel waveguide, a ridge waveguide, a strip loaded waveguide, and a strip loaded waveguide having a low index transition region. However, Examiner has not cited specifically what portion of the teachings of Deliwala or Li et al. render obvious Applicant's claim 50. Applicant asserts that neither Deliwala nor Li et al. discuss implicitly or expressly the planar guiding portion as taught in Applicant's claim 50, and thus cannot be considered to render Applicant's claim obvious. Therefore, in light of the above, Applicant respectfully requests that a 103(a) rejection to claim 50 be withdrawn and a notice of allowance be made.

Claim 51

Regarding claim 51, it is well known in the art, as is stated by Li et al. that "within a waveguide grating region the guided wave is an exponentially decaying electromagnetic wave along the propagation direction." However, neither Li nor Deliwala, teach of a relationship by which is engineered a decreasing optical power distribution between first and second ends of a planar grating portion. While the teachings of Deliwala and Li et al. consider the exponentially decaying electromagnetic wave along the propagation direction to ensure their inventions' practicability, Applicant's claim 51 teaches of a relationship which optimizes the invention in light of the natural optical properties of light. Clearly, there is nothing obvious in Applicant's claim 51 in light of the cited teachings. Applicant disagrees with Examiner and respectfully requests that, in light of the above, a 103(a) rejection to claim 51 be withdrawn and a notice of allowance be made.

Claims 52 and 53

Examiner rejected claims 52 and 53 as being obvious in view of Li et al. Applicant respectfully disagrees with Examiner. Examiner has acknowledged that Li et al. does not expressly teach a plot of the magnitudes of "said characteristic associated with said widths versus position along said guiding portion containing more that two elongate scattering elements..." Nowhere in Li's teaching is anything about the teaching of claim 52 even implied. Additionally, claim 53 recites a specific figure of at least 20 elongate scattering elements. Surely, it would be appreciated that for even a skilled artisan, the taught figure of 20 elongate scattering elements couldn't be arrived at without

reasonable experimentation. Applicant hereby asserts that claims 52 and 53 are not obvious in light of the teachings of Li et al. Consequently, in light of the above, Applicant respectfully requests that a 103(a) rejection to claims 52 and 53 be withdrawn and a notice of allowance be made.

Claim 54

Regarding claim 54 the relationship satisfied does not correspond to the width to pitch ratio as disclosed by Li et al. Applicant disagrees with Examiner's contention that the relationship taught in claim 54 would be obvious to one skilled in the art in light of the teachings of Li et al without undue experimentation. Consequently, in light of the above, Applicant respectfully requests that a 103(a) rejection to claim 54 be withdrawn and a notice of allowance be made.

Claim 55

Regarding claim 55, Applicant disagrees with Examiner's rejection. The cited reference does not teach of the "substantially planar wave oriented at an angle with respect to said planar guiding portion" rather the specification of Li et al teaches of a parallelogramic waveguide grating structure. Further, "elongate scattering elements in said planar guiding portion having spacing selected to scatter light within said waveguide out of said planar guiding portion into a beam directed at said angle" is supported by the specification where the angle and spacing is elaborated. This unlike the cited reference, wherein a person skilled in the art would be unable to implement Applicant's claim 55 without undue trial and experimentation. Consequently, and in light of the above,

Applicant respectfully requests that a 103(a) rejection to claim 55 be withdrawn and a notice of allowance be made.

Allowable Subject Matter

Examiner objected to claim 32 as being dependent upon a rejected base claim 31. As shown above, claim 31 is not obvious in light of the cited references, and a request for notice of allowance has been made. Consequently, claim 32 does not need to be re-written in independent form. In light of the above, applicant thus requests that a notice of allowance for claim 32 be issued.

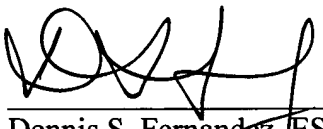
CONCLUSION

In view of the foregoing, the Applicant believes that all of the claims are now in condition for allowance and respectfully request the Examiner to issue a timely Notice of Allowance in this case. If for any reason, the Examiner believes any of the claims are not in condition for allowance, he is encouraged to call the undersigned attorney at 650-325-4999 so that any remaining issues may be resolved.

The above arguments do not draw from new matter, as support for the arguments is found in the specification.

Claims 7, 13, 14, 26, 29, 30, 37, 43, 44, and 56 have been cancelled. Claims 8, 32, 38, 47, 48, 51-52 have been amended. Claims 1-6, 8-12, 15-25, 27-28, 31-36, 38-42, 45-55 remain in this application. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,



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